

and period for which the material available to us had to be heated in order to obtain a satisfactory yield of helium. The electric furnace used could be maintained approximately steady ( $\pm 10^\circ$ ) at temperatures up to 1,100–1,200° C. The purification of the gas obtained was effected as usual, the coconut-shell charcoal cooled in liquid air having been degassed previously in a Töpler vacuum by heating for over 24 hours in a bath of sulphur vapour. The measurement of the volume of helium was carried out in a constant volume burette<sup>1</sup> having two fixed glass pointers which corresponded to 2.742 c.c. and 9.380 c.c. respectively. The error in the determination of volume was not more than 1.5 c. mm. in any experiment.

As a result of several trials it was found that in order to liberate all the helium from the sample in a reasonably short period (4 hours), it was necessary to heat the material at a temperature of about 1,000–1,100° C. The quantities of helium obtained from the 40 and the 80-mesh samples were respectively 0.850 and 0.903 c.c. per gram of the material. The rate of evolution of helium when monazite is heated at 1,100° C. in a Töpler vacuum was studied, and the results of one typical experiment showing the quantities evolved during the progress of heating are given below :

|   |    |                  |                  |     |     |     |
|---|----|------------------|------------------|-----|-----|-----|
| Period of heating<br>(in hours)             | .. | 0— $\frac{1}{2}$ | $\frac{1}{2}$ —1 | 1—2 | 2—4 | 4—5 |
| Helium obtained<br>(percentage of<br>total) | .. | 90.7             | 5.8              | 1.5 | 2.0 | 0.0 |

P. R. SUBBARAMAN.  
K. R. KRISHNASWAMI.

Department of General Chemistry,  
Indian Institute of Science,  
Bangalore,  
July 29, 1938.

<sup>1</sup> *J. Ind. Inst. Sci.*, 1934, 17 A, Part III, 36.

### Spilitic Rocks from Chitaldrug, Mysore State.

IN a short paper published a few years ago,<sup>1</sup> the present writer gave a general petrographic account of the trap rocks of the Chitaldrug Schist Belt. The present note deals with the Jogimardi trap (the Chitaldrug grey trap of some writers), and the dark hornblendic trap of Chitaldrug.

The Jogimardi trap is a grey coloured, heavy basic rock. It exhibits a great variety of textures, varying from glassy and fine-grained types, to coarse rocks with ophitic or sub-ophitic textures. Sometimes, these rocks are also porphyritic. Augite, mostly altered to uraltite and chlorite, and decomposed plagioclase, constitute the important minerals. The feldspars are invariably altered, but in a few favourable cases it was possible to determine that the refractive index was distinctly lower than that of Canada balsam; the species may therefore be referred to albite or acid oligoclase. Quartz occurs sporadically. Feebly pleochroic pale yellow epidote, and calcite are the common secondary minerals. Sphene and ilmenite are always present. These traps do not contain olivine or rhombic pyroxene.

The dark hornblendic trap is of a deeper colour than the Jogimardi trap, a character mainly due to the colour of the amphibole, which is deep-tinted with well-marked pleochroism from yellow to green to greenish blue. The feldspars are highly altered and so it is not possible to determine their exact nature. There is no augite in any of the sections examined by the writer. Magnetite, pyrites, and ilmenite occur as accessories. In a few cases, an ophitic texture is just discernible.

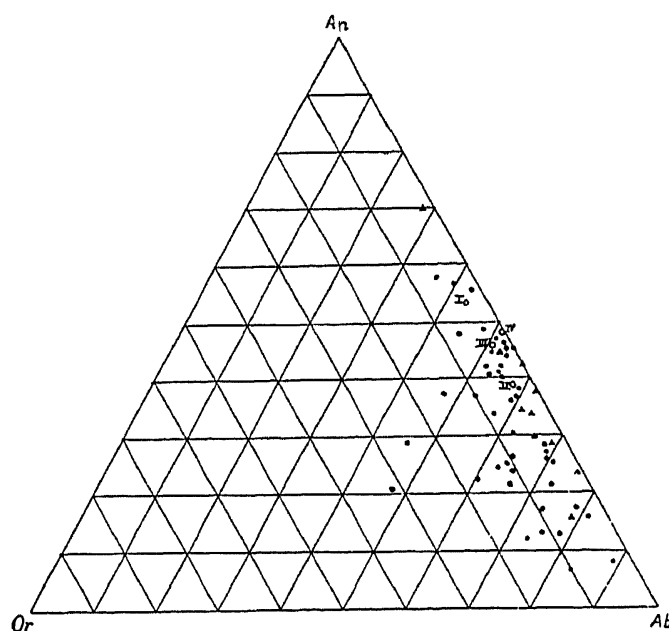


FIG. 1.

Molecular percentages of normative feldspars of spilites. British spilites are represented by triangles and the Chitaldrug rocks by circles. Spilites from other parts of the world are indicated by dots.

The chemical composition of these traps may be seen from the analyses given in the accompanying table. Columns I and II are analyses of Jogimardi traps, column III gives an average of I and II, and column IV is the analysis of a specimen of the dark hornblendic trap. Alongside these are placed, for purposes of comparison, the analyses of a few spilitic rocks from other parts of the world, as well as the composition of average spilitic according to Wells and Sundius.

and a relatively high soda content, varying from 2.27 per cent. to 3.70 per cent. These are characteristic features of spilitic rocks, and in this respect, these rocks are comparable to the spilites from other parts of the world, though the percentage of soda is not so high as in the average spilites of Wells or Sundius.

The composition of the normative feldspars in these rocks is best seen by plotting the calculated molecules in an orthoclase-albite-anorthite triangle. This has been done

|                                   | I     | A      | B      | C     | II     | III   | D      | E      | IV    |                                |
|-----------------------------------|-------|--------|--------|-------|--------|-------|--------|--------|-------|--------------------------------|
| SiO <sub>2</sub> ..               | 47.44 | 47.45  | 48.58  | 48.55 | 48.52  | 47.98 | 46.01  | 51.22  | 52.60 | SiO <sub>2</sub>               |
| Al <sub>2</sub> O <sub>3</sub> .. | 16.28 | 17.54* | 14.58  | 13.50 | 13.80  | 15.04 | 15.21  | 13.66  | 10.12 | Al <sub>2</sub> O <sub>3</sub> |
| Fe <sub>2</sub> O <sub>3</sub> .. | 3.27  | 2.04   | 1.89   | 3.56  | 3.65   | 3.46  | 1.35   | 2.84   | 3.84  | Fe <sub>2</sub> O <sub>3</sub> |
| FeO ..                            | 9.76  | 7.44   | 7.65   | 10.20 | 9.83   | 9.79  | 8.69   | 9.20   | 12.73 | FeO                            |
| MgO ..                            | 5.20  | 6.72   | 6.36   | 7.37  | 5.88   | 5.54  | 4.18   | 4.55   | 6.17  | MgO                            |
| CaO ..                            | 11.22 | 10.96  | 9.80   | 8.58  | 10.92  | 11.07 | 8.64   | 6.89   | 9.36  | CaO                            |
| Na <sub>2</sub> O ..              | 2.94  | 3.93   | 4.02   | 2.94  | 3.70   | 3.32  | 4.97   | 4.93   | 2.27  | Na <sub>2</sub> O              |
| K <sub>2</sub> O ..               | 0.34  | tr     | 0.43   | 0.32  | 0.32   | 0.33  | 0.34   | 0.75   | tr    | K <sub>2</sub> O               |
| TiO <sub>2</sub> ..               | 0.90  | ..     | 1.77   | 1.13  | 1.04   | 0.97  | 2.21   | 3.32   | 1.12  | TiO <sub>2</sub>               |
| P <sub>2</sub> O <sub>5</sub> ..  | 0.09  | n.d    | 0.19   | 0.09  | 0.10   | 0.10  | 0.61   | 0.29   | n.d   | P <sub>2</sub> O <sub>5</sub>  |
| MnO ..                            | 0.18  | n.d    | 0.46   | 0.27  | 0.14   | 0.16  | 0.33   | 0.25   | 0.03  | MnO                            |
| H <sub>2</sub> O ..               | ..    | 2.90   | 3.61   | 3.24  | ..     | ..    | 2.48   | 1.88   | 1.60  | H <sub>2</sub> O               |
| Loss on ignition                  | 2.19  | ..     | ..     | ..    | 2.12   | 2.15  | ..     | ..     | ..    | Loss on ignition               |
| Other constituents                | ..    | 0.55   | 1.29   | 0.16  | ..     | ..    | 4.98   | 0.94   | ..    | Other constituents             |
|                                   | 99.81 | 99.53  | 100.63 | 99.91 | 100.02 | 99.91 | 100.00 | 100.72 | 99.84 |                                |

\* includes TiO<sub>2</sub>.

I.—Jogimardi Trap, Chitaldrug, Mysore State. Analyst: E. R. Tirumalachar.

A.—Gwna Spilitic, Bryn Llwd, Newborough Dunes, Anglesey. Analyst: J. O. Hughes (*Mem. Geol. Surv., Geology of Anglesey*, 1919, 1, 74).

B.—Spilitic, Mullion Island, Cornwall. Analyst: W. Pollard (*Mem. Geol. Surv., Geology of the Lizard*, 1912, 185).

C.—Greenstone, Valkeasiipivaara, Kiruna, Sweden. Analyst: A. Bygden ('On the spilitic rocks,' *N. Sundius, Geol. Mag.*, 1930, 67, 6).

II.—Fine-grained Jogimardi Trap, Chitaldrug, Mysore State. Analyst: E. R. Tirumalachar.

III.—Average of Jogimardi trap analyses I and II.

D.—Average Spilitic, according to A. K. Wells ('Nomenclature of the Spilitic Suite,' *Geol. Mag.*, 1923, 60, 59).

E.—Average Spilitic, according to N. Sundius (*Geol. Mag.*, 1930, 67, 9).

IV.—Fine-grained dark hornblendic trap, Chitaldrug, Mysore State. Analyst: E. R. Tirumalachar.

It will be seen from the table of analyses that both these traps from Chitaldrug are characterised by a very low potash content (from just a trace in the dark hornblendic trap to 0.34 per cent. in the Jogimardi trap),

in the accompanying diagram, where the circles represent the composition of the normative feldspars of the Chitaldrug traps. It will be noticed that their positions correspond very well with the normative feldspars

of other well-known spilites, and fall within a narrow zone along the plagioclase line.

It is well known that spilitic rocks often show the characteristic pillow structure in the field. The recently reported occurrence of pillow structure<sup>2</sup> in the Chitaldrug traps is, therefore, of special significance as indicating the spilitic character of these rocks which must have originated as submarine flows.

Attention may also be drawn here to two rock types associated with the traps of this area, which have been described by the late Professor P. Sampat Iyengar<sup>3</sup> under the names Talvati felsite, and Anabur (or Pitlali) granite. By the courtesy of the Director of Geology in Mysore, the present writer examined a few specimens and slides of these rocks, and it was found that the Talvati felsite is a dark compact rock with sub-conchoidal fracture, containing abundant rounded or oval grains of quartz which appear almost black in colour, with a few small phenocrysts of feldspar. The rock weathers grey or greyish white. Under the microscope, the feldspars are seen to occur in individual crystals, glomeroporphyritic aggregates, and as minute grains in the matrix. The index of refraction and angles of extinction indicate an albite of composition  $Ab_{95}An_5$ . The quartz grains are invariably deeply corroded and embayed. Greenish biotite occurs in small shreds and flakes. Thin veins of epidote traverse the rock. This rock corresponds in most particulars to a quartz-keratophyre.

The Anabur or Pitlali granite which borders the Chitaldrug Schist Belt for more than fifty miles, is a gneissose rock containing albite of composition  $Ab_{92}An_8$ .

Keratophyres, quartz-keratophyres, and soda-granites are invariably associated elsewhere with spilitic rocks. Therefore, the presence in the Chitaldrug area of these sodalase bearing rocks associated with the traps is yet another argument which supports the view that here we have a suite of rocks belonging to the spilitic series.

CHARLES S. PICHAMUTHU.

Department of Geology,

University of Mysore,

Bangalore.

July 28, 1938.

## A Study of the Feldspars from the Mica Pegmatites of Nellore.

THESE feldspars comprise different types varying in composition and mineralogical properties. The most common of these is an albite with a  $Na_2O$  content of about 10 per cent. and an orthoclase with a potash content of about 16 per cent. In addition to these two main types there are also found appreciable quantities of perthites and microperthites, the most conspicuous of these being a beautiful green moonstone composed of a perthite-microperthite. A flesh-red microcline with typical microcline structure is also present in large quantities.

A quantitative study of almost all the main types of these feldspars was carried out both chemically and microscopically. The potash member in the flesh-red specimens of perthites and microperthites was found to be microcline, while in the other specimens, it was a moonstone of an orthoclase type. In the green feldspars the potash member is always green having very fine microcline twinning. The presence of this microcline twinning led to the common and erroneous view that this feldspar was microcline. But it differs from microcline in many of the essential optical properties. Sections cut parallel to (001) show straight extinction with reference to the trace of (010) cleavage. In addition, sections cut parallel to (010) show almost symmetrical interference figures in convergent polarized light. These observations show that it is not microcline but a moonstone of the orthoclase type. It is not an orthoclase as its sodium content was found to be very low. The microcline structure is perhaps an anorthoclase effect produced by that portion of albite which is in solid solution in the potash member.

Results obtained from chemical and micro-metric data show definitely that mutual solubility exists between the *Or* (potash member) and *Ab* members on the one hand and *Ab* and *An* members of these feldspars on the other, whereas the *Or* and *An* members are not miscible. It is also noticed that *Ab* is more soluble in *Or* than *Or* in *Ab*.

The perthitic structure and the microcline twinning of these moonstones are not destroyed by heat, but continued heating at a temperature of about 1000° gives rise to a change in the potash member at its contact with the albite member. The sharp contact

<sup>1</sup> Pichamuthu, C. S., *Rec. Mys. Geol. Dept.*, 1930, 27, 20-32.

<sup>2</sup> Raghunatha Rao, B. N., *Curr. Sci.*, 1937, 6, 279.

<sup>3</sup> Sampat Iyengar, P., *Rec. Mys. Geol. Dept.*, 1905, 6, 64, 86.